



**University of
Zurich^{UZH}**

**Zurich Open Repository and
Archive**

University of Zurich
University Library
Strickhofstrasse 39
CH-8057 Zurich
www.zora.uzh.ch

Year: 2016

The Effectiveness of the Life Skills Program IPSY for the Prevention of Adolescent Tobacco Use: The Mediating Role of Yielding to Peer Pressure

Weichold, K ; Tomasik, M J ; Silbereisen, R K ; Spaeth, M

Abstract: In this study, the effectiveness of a life skills program to impede tobacco use in early adolescence was scrutinized. The focus was on the mediating role of yielding to peer pressure. The universal school-based life skills program IPSY (Information + Psychosocial Competence = Protection) against adolescent substance use was implemented over 3 years. Over the same time period, it was evaluated based on a longitudinal quasi-experimental design with an intervention and comparison group (4 measurement points; N = 1,657 German students, age 10 at T1). By applying a growth curve modeling approach, we found that participation in IPSY compared with non-participation predicted a slower increase in tobacco use over time, suggesting a significant intervention effect. Moreover, a parallel growth curve model revealed that less yielding to peer pressure induced by IPSY mediated the program effects on tobacco use over time.

DOI: <https://doi.org/10.1177/0272431615589349>

Posted at the Zurich Open Repository and Archive, University of Zurich

ZORA URL: <https://doi.org/10.5167/uzh-120310>

Journal Article

Accepted Version

Originally published at:

Weichold, K; Tomasik, M J; Silbereisen, R K; Spaeth, M (2016). The Effectiveness of the Life Skills Program IPSY for the Prevention of Adolescent Tobacco Use: The Mediating Role of Yielding to Peer Pressure. *Journal of Early Adolescence*, 36(7):881-908.

DOI: <https://doi.org/10.1177/0272431615589349>

The Effectiveness of the Life Skills Program IPSY for the Prevention of Adolescent Tobacco

Use: The Mediating Role of Yielding to Peer Pressure

Karina Weichold

Friedrich Schiller University of Jena, Germany

Martin J. Tomasik

University of Zurich, Switzerland

Rainer K. Silbereisen,

Friedrich Schiller University of Jena, Germany

and

Michael Spaeth

Hannover Medical School, Germany

karina.weichold@uni-jena.de

tomasik@psychologie.uzh.ch

rainer.silbereisen@uni-jena.de

spaeth.michael@mh-hannover.de

Corresponding author:

Karina Weichold

Department of Psychology

University of Jena

Am Steiger 3/ Haus 1

D – 07745 Jena

Phone/Fax: 0049 (0) 3641 945221 / 0049 (0) 3641 94520

Abstract

In this study the effectiveness of a life skills program to impede tobacco use in early adolescence was scrutinized. The focus was on the mediating role of yielding to peer pressure. The universal school-based life skills program IPSY (Information + Psychosocial Competence = Protection) against adolescent substance use was implemented over three years. Over the same time period it was evaluated based on a longitudinal quasi-experimental design with intervention and comparison group (four measurement points; $N = 1,657$ German students, age 10 years at T1). By applying a growth curve modeling approach, we found that participation in IPSY predicted a slower increase in tobacco use over time than the rate of increase shown by the comparison group, suggesting a significant intervention effect. Moreover, a parallel growth curve model revealed that a lower yielding to peer pressure induced by IPSY mediated the program effects on tobacco use over time.

Keywords: intervention/prevention, tobacco use/smoking, peers, school context

Introduction

Although prevalence of tobacco use among adolescents declined in recent decades in many countries around the world, current international survey data still reveal that adolescents remain attracted to smoking. During early adolescence, prevalence rates (smoked at least once per week) are typically still very low (age 11: 1% girls, 1% boys), but increase tremendously during the course of adolescence (age 13: 5% girls, 6% boys; age 15: 17% girls, 19% boys). On average, at age 15, 22% of the girls and 26% of the boys reported that they had started smoking at age 13 or younger (Currie et al., 2012). Such average rates vary between nations. For instance, German adolescents (who are the focus of this study) as compared to their U.S. American age mates show higher prevalence rates in smoking and a higher proportion of 15-year-olds with early onset tobacco use (e.g., at age 13 or younger: 20% girls, 24% boys in Germany vs. 11% girls, 14% boys in the U.S.).

In particular, early onset and high tobacco use in early adolescence increases both the risk for tobacco and other substance abuse in adulthood, and the risk of serious diseases such as cancer (Haas & Smith, 2012; Santelli, Sivaramakrishnan, Edelstein, & Fried, 2013). Thus, the tremendous negative consequences of tobacco use in and throughout adolescence demand adequate, theory-based preventive interventions to restrain young people from becoming regular adult smokers, in particular in regions of the world where early tobacco use is a prevalent phenomenon.

Explanations of adolescent tobacco use (MacKinnon, Taborga, & Morgan-Lopez, 2002; Scheier, 2010) stress the primary influence of peers (e.g., Andrews & Hops, 2010; Hoffman, Sussman, Unger, & Valente, 2006; Kobus, 2003; Pandina, Johnson, & White, 2010). The effects of both socialization by and selection of peers on adolescent substance use have been well documented in recent works (for summaries, see Andrews & Hops, 2010;

PREVENTION OF TOBACCO USE

Simons-Morton & Farhat, 2010). The influence and perceived pressure to smoke of deviant, substance-using peers, however, is especially strong in prompting early adolescents as compared to youth in mid and late adolescence to initiate a life-long habit (Li, Barrera, Hops, Fischer, & Harmer, 2002). This seems to be due to the fact that many times early adolescents feel the need to smoke if others around them do so, in order to access peer group membership, and to avoid social exclusion (Kobus, 2003). Thus, inexperienced users in early adolescence while striving for social homophily, similarity in consumption habits and peer acceptance, are more likely to follow the lead of best friends, peers, and wider social networks whose members urge or model substance use (Sussman, Pokhrel, Ashmore, & Brown, 2007; Valente, Gallaher, & Mouttapa, 2004). In line with this, the majority of early adolescents initiate smoking in the context of their peers (Bundeszentrale für gesundheitliche Aufklärung [BZgA], 2011). In addition, studies demonstrated that naïve adolescents tend to overestimate peers' level of substance use and to assume that regular use is normative (Simons-Morton & Farhat, 2010). In mid to late adolescence, in contrast, substance use increasingly becomes a matter of personal choice (McIntosh, MacDonald, & McKeganey, 2006), and the impact of peers decreases over time (Jaccard, Blanton, & Dodge, 2005). Based on this, the need to consider the differential impact of peers on substance use as varying during the course of adolescence in basic and applied research has been highlighted. Thereby, early adolescence seems to be of particular salience as smoking is relatively novel and serves, in part, as an entrance requirement to a group (Pandina, Johnson, & White, 2010).

Resistance to tobacco use offerings within the peer context can be moderated by parental influences (Simons-Morton & Farhat, 2010), personality, and also by social competence such as refusal assertiveness to resist passive and active peer influences (Andrews & Hops, 2010; Griffin & Botvin, 2010). Studies demonstrated that high levels of adolescent resistance skills promote low substance use in early adolescence (Hopfer, Hecht,

PREVENTION OF TOBACCO USE

Lanza, Tan, & Xu, 2013). Consequently, from a prevention perspective it seems particularly promising to enhance social development (e.g., refusal and decision-making skills to withstand potential deviant peer influences) and to improve positive peer relations in order to prevent tobacco use during the early stage of adolescence (Andrews & Hops, 2010; Griffin & Botvin, 2010; Hoffman et al., 2006).

Numerous prevention programs (most of them in school settings) have attempted to influence the consumption of tobacco in young people (e.g., Kumar, O'Malley, Johnston, & Laetz, 2013). Recent reviews of empirical data confirm the view that universal school-based prevention programs against tobacco use in adolescence can indeed positively influence consumption behavior, in the short and long term (Dobbins, DeCorby, & Manske, & Goldblatt, 2008; LaTorre, Chiaradia, & Ricciardi, 2005; Skara & Sussman, 2003; Thomas, McLellan, & Perera, 2013), and these programs can yield beneficial health effects beyond adolescence and early adulthood (Jit, Aveyard, Barton, & Meads, 2010). This is particularly true of programs grounded in the social influence approach (Skara & Sussman, 2003), those based on a combination of the social competence and social influence approaches (Thomas, McLellan, & Perera, 2013), or those embedded in more comprehensive school health prevention measures (LaTorre et al., 2005). In addition, school-based prevention programs against tobacco and other substance use were successful in the past if they were delivered interactively, if they taught skills to refuse drug offers and to resist pro-drug influences, and if they corrected misperceptions about usage normativity and enhanced social and personal competence (Botvin & Griffin, 2007; Hansen et al., 2010). All these characteristics seem to be adequately reflected in school-based prevention programs utilizing the life skills approach which has been demonstrated to effectively prevent early and high tobacco use in adolescence (Griffin & Botvin, 2010; WHO, 2011).

PREVENTION OF TOBACCO USE

Life skills programs promote general competencies in the interpersonal (e.g., assertiveness) and intrapersonal (e.g., self-esteem) domains. In addition, students acquire substance-specific skills and knowledge (WHO, 1997, 2011). These programs help adolescents to face everyday challenges while striving to complete their age-related developmental tasks, such as establishing new peer relationships. Another goal of life skills programs is to reduce the likelihood of substance use as a pseudo-mature behavior (e.g., imitating adult behavior by offering a cigarette to get closer to someone) or a coping strategy (e.g., as compensation for adolescent failure to complete developmental tasks) (Griffin & Botvin, 2010; Schulenberg, Maggs, Steinman, & Zucker, 2001).

Although there is consensus among investigators that school-based universal prevention programs against tobacco use in adolescence are effective, there is still a lack of empirical evidence on the mediating mechanisms. Addressing this question is important for both theoretical and practical reasons. Through clarification of the identity and role of mediators, existing programs can be optimized (MacKinnon et al., 2002) and knowledge of the etiology of problem behaviors compiled. If the modification of a risk or protective factor via an intervention program leads to a reduced increase in substance use over time then this factor seems to be a causal agent. In addition, because changes in risk or protective factors usually precede the onset of problem behaviors, confidence about the direction of the effect increases. Finally, the design of evaluation studies including the comparison of an intervention and comparison group provides strong evidence that the mediation effect is not caused by factors exogenous to the intervention program (Howe, Reiss, & Yuh, 2002).

Primary mediators identified by past research are knowledge about negative health effects of tobacco, beliefs about the social consequences of tobacco use, and self-efficacy, as shown by reduced usage intentions or actual reduced use after program participation (Stigler, Perry, Smolenski, Arora, & Reddy, 2011). In addition, Stephens and colleagues (Stephens et

PREVENTION OF TOBACCO USE

al., 2009) demonstrated that intentions to smoke mediated the effects of program participation on tobacco use, while the majority of program variables did not have a direct effect on consumption behaviors. Finally, other studies found lifestyle incongruence, commitment not to use (McNeal, Hansen, Harrington, & Giles, 2004), perceived information helpfulness of the program (Huang, Unger, & Rohrbach, 2000), and family problem solving (DeGarmo, Eddy, Reid, & Fetrow, 2009) to act as mediators of program effects, as did change in normative beliefs of prevalence estimates and attitudes towards consumption (Liu, Flay, & Aban Aya Investigators, 2009).

With regard to peer influences, recent studies indicate that friends' disruptive behaviors (van Lier, Huizink, & Vuijk, 2011), normative beliefs about peers' frequency of substance use (Ringwaldt et al., 2009), reduced peer aggression (DeGarmo et al., 2009), and perception of friends' use (Sakuma, Sun, Unger, & Johnson, 2010) acted as mediators of program effects. Changes in perceived friends' encouragement to use and in friends' consumption behavior also mediated program effects on growth in substance use during adolescence (Liu et al., 2009). Finally, peer influence (i.e., peers' respect for refusing, friends' approval of substance use, and perceived prevalence of smokers among acquaintances and friends) and the self-efficacy to resist them were mediators of program effects on tobacco use (Orlando, Ellickson, McCaffrey, & Longshore, 2005).

Although some of these programs followed the social influence approach (which is also part of the theoretical basis of the life skills programs), only a few studies focused on the investigation of mediators of the effects of school-based life skills programs on tobacco use. First, the evaluation of the *Life Skills Training* (LST) indicated that prevention effects on tobacco use were (partly) mediated by risk taking, and behavioral intentions. In contrast, normative expectation, attitudes, knowledge, and various aspects of social and personal competence (e.g., decision making, assertiveness, refusal skills, communication skills) did not

PREVENTION OF TOBACCO USE

act as mediators of program effects regarding tobacco use (Botvin, Griffin, Diaz, & Ifill-Williams, 2001). Second, the evaluation of the program *Think Smart* did not find that proposed risk and protective factors (e.g., peer use, peer normative beliefs about consumption, assertiveness skills) mediated program effects on substance use, including smoking (Johnson, Shamblen, Ogilvie, Collins, & Saylor, 2009). Third, Bühler, Schröder, and Silbereisen (2008) demonstrated that positive effects of a life skills program were mediated by increased knowledge about life skills, among them assertiveness, which paralleled an increase in students' distancing attitudes towards tobacco use.

In sum, with the evaluation of school-based prevention programs against adolescent substance use, various mediators were identified, and many of them lie in the area of peer influence, the main context of influence on adolescent substance use behavior. Significantly, findings on the evaluation of life skills programs are rare and inconclusive, and most studies did not explicitly investigate the role of refusal skills towards peer pressure.

In addition, most studies in this field investigated samples in mid to late adolescence rather than early adolescence. In early adolescence (as outlined above), however, tobacco use and its initiation seem to be particularly closely tied to the peer context when early adolescents feel the need to smoke if others around them do so, in order to access peer group membership, and to avoid social exclusion (e.g., Kobus, 2003).

Finally, the vast majority of studies are based on U.S. samples, but cultural differences may limit the transfer of findings to the European context. More specifically, in Germany, as compared to the U.S., prevalence rates of tobacco use are not only higher during adolescence but also in adulthood. In addition, the general cultural acceptance of smoking is higher in Germany with fewer restrictions on public smoking (World Health Organization [WHO], 2013), more visible advertisement for tobacco products, and higher exposure to smoking actors in movies (e.g., Hanewinkel & Sargent, 2007). Although Germany agreed to adhere to

PREVENTION OF TOBACCO USE

the Framework Convention on Tobacco Control of the World Health Organization in 2003, and smoking bans in school are regulated by law since 2007, the translation of associated strategies into school settings (e.g., creating smoke-free school environments) has progressed very slowly and exceptions to the rules (e.g., smoking allowed for pupils from age 16 onwards) are common in schools (Pötschke-Langer, 2005). Thus, German in contrast to U.S. American adolescents are more often exposed to role models who seem to accept or approve smoking behavior, and to various pro-smoking cues in their proximal and distal environments, all of which are known to reduce risk perceptions and to increase normativity expectations of smoking, and, consequently, increase early adolescent tobacco use (e.g., Helweg-Larsen & Nielsen, 2009; Piontek et al., 2008).

Against this background, the current study aimed at investigating the general effectiveness of a universal school-based life skills program focusing on tobacco use in early adolescence across three years in a German context (*Aim 1*). Therefore, we examined the individual trajectories of tobacco use in adolescents between the ages of 10 and 13 years as a function of participation in a school-based life skills program. We measured frequency of smoking in the last 30 days, and assumed that such frequency could be sufficiently well described by a linear growth model. Because the life skills program was intended to postpone substance use in early developmental stages and encourage a slower age-typical increase during adolescence, we hypothesized that students in the intervention group would report a significantly slower increase in smoking as compared to students in the comparison group (*Hypothesis 1*).

The second and central goal of this study was to investigate whether the mediating role of yielding to peer pressure was possibly responsible for the positive program effect (*Aim 2*). Yielding to (vs. resisting) peer pressure was selected as a mediator variable because it reflects a major risk factor for tobacco use in early adolescence, and a resistance is a central learning

PREVENTION OF TOBACCO USE

goal of the program under investigation. We posited that a slower increase in yielding to peer pressure in the intervention group compared to the comparison group mediates the positive effect of the life skills program on tobacco use (*Hypothesis 2*).

Method

Sample

Selection of the sample. The sample of the longitudinal evaluation study comprised fifth graders from Thuringia, Germany. The study was approved by the Thuringian State Ministry of Culture and Education, and schools participated on a voluntary basis. A letter was sent from the Ministry to all 403 schools of the two main tracks (*Regelschule* and *Gymnasium*) of Thuringia inviting them to an informative meeting on this intervention program. Because schools have been receiving similar invitations on a regular basis, or may already have been involved in similar activities, the response rate was rather low with only 40 schools accepting the invitation. Reasons given for participation varied and included specific interest in substance misuse at schools, or the enhancement of school prestige. Based on official statistical data, the 40 schools which indicated interest were slightly more likely to be situated in larger towns (>20.000 inhabitants, with largest town approx. 200,000 inhabitants) of the federal state (i.e., 16% of schools from larger towns, and 7% of schools from smaller towns followed the invitation to the meeting). This finding is not surprising, because larger towns have a better infrastructure supporting fast and easy travel to a meeting announced by the Ministry in the capital of the federal state. In addition, schools from larger towns may be more aware of the topic of adolescent substance use because urban adolescents usually show a higher prevalence rates of substance use; Fend, 2005), and may respond more promptly to an invitation to participate in a smoking prevention program. Thus the distribution of prevention programs seems to be more easily accomplished in schools of larger towns. Finally, all public

PREVENTION OF TOBACCO USE

schools of the federal state, by law, have to ensure an integrative, high-level, and free-of-charge education for all children and adolescents, thus reducing the likelihood of large differences in the quality of school environments, teaching situations, or further socio-demographic background variables of schools with and without interest in the program.

During the informational meeting on the intervention study, teachers were introduced to the general framework of the IPSY program and to the rules of participation, which included cooperation in an evaluation study. All 40 schools were willing to participate. As we could handle only a smaller number of schools in the evaluation study (due to the planned budget), 23 schools were selected at random to be intervention schools for our study. It was not possible to retain the remaining schools ($N = 17$) as a control or intent-to-treat group because they expected to see the program implemented as soon as possible and were not prepared to wait several years until implementation (manual and training were provided for these schools). For this reason, comparison schools were recruited at random from the remaining 363 schools of the state. Twenty-three randomly selected schools were contacted by the principal investigator and encouraged to participate by the Ministry; 21 of them agreed to form the comparison group.

Data of former involvement in intervention efforts as reported by school leaders were compared between schools of the intervention and comparison group. In both groups, about one-third had participated in interventions in the past suggesting that they did not differ in their general interest in school-based interventions. All schools of the sample were situated in typical middle-class environments of small and middle-sized towns in the federal state of Thuringia. No significant differences were found with regard to size and number of inhabitants of communities where intervention vs. comparison schools were situated (based on official statistics). Thus, it is not the case that schools of the intervention group were more likely than the comparison group to be placed in larger towns where adolescents usually

PREVENTION OF TOBACCO USE

report higher smoking prevalence rates (Fend, 2005). Finally, as mentioned above, all public schools in each federal state, by law, must ensure an integrative, high-level, and free-of-charge education for all children and adolescents. Thus, large differences between intervention and comparison schools with regard to the quality of school environments, teaching situations, or socio-demographic background variables are unlikely. This view is supported by data on $N = 165$ teachers who participated in the study (i.e., implementing teachers in the intervention group vs. class teachers in the comparison group, pre-test comparisons) which indicated that teachers who conveyed the program did not differ from teachers in the comparison condition with regard to socio-demographics (age, gender, family status etc.), school-related self-efficacy, average classroom climate and school-bonding as assessed by their students, and number of students in the classroom (for more details see Grünbaum, 2009).

Sample description. The original sample consisted of $N = 1,693$ students recruited for the pre-test. After an analysis of outliers we excluded one school¹ and eight additional students who were identified as multivariate outliers based on Cook's D . These exclusions resulted in an effective sample size of $N = 1,657$ consisting of 52.9% girls and 47.1% boys. The sample had a mean age of $M = 10.47$ ($SD = 0.64$) years at pre-test. About 96% of the sample had German nationality. In addition, 73% of the students reported a “good” to “very good” financial background. At the subsequent measurement occasions, the participation rate based on the full sample at pre-test was 84% at T2, 76% at T3, and 67% at T4. About 56% of the entire sample was in the intervention group and 44% in the comparison group. Approximately six out of ten participants belonged to the college-bound school track (i.e., *Gymnasium*) whereas the others attended the vocational school track (i.e., *Regelschule*). Comparisons with official data suggested that our sample appears to represent the normal population of young adolescents, at least in Thuringia.

Differences between intervention and comparison group at pre-test. There were no significant differences between the intervention group and the comparison group at the pre-test on various background variables including the number of siblings, $t(1594) = 1.15, p = .25$, Cohen's $d = .06$, the subjective evaluation of the families' financial situation, $t(1615) = 1.32, p = .19$, and pubertal status in terms of self-reported growth of pubic hair, $t(1595) = .70, p = .48, d = .04$. We also found no significant group differences on initial frequency of tobacco use, $t(1636) = .147, p = .14, d = .07$. Also, students in the intervention group did not differ from students in the comparison group in self-reported yielding to peer pressure, $t(1598) = 1.89, p = .06, d = .10$, which is the hypothesized mediator. However, students in the intervention group were somewhat younger ($M = 10.42$ years) compared to the comparison group, $M = 10.54$; $t(1649) = 3.77, p < .01, d = .19$. Also, there were relatively more boys in the intervention group (56%) as compared to the comparison group (51%), $\chi^2(1, N = 1655) = 4.26, p < .05, d = .10$. Both of these significant pre-test differences between the intervention and comparison group, however, were small in terms of effect size (cf. Cohen, 1988).

Intervention

IPSY (Information + Psychosocial Competence = Protection) is a universal school-based life skills program that aims to delay the onset of substance use and to reduce the normative increase in such use in early adolescence (Weichold, 2007; see also Spaeth, Weichold, Silbereisen, & Wiesner, 2010; Weichold, Brambosch, & Silbereisen, 2012). The program is based on the model for life skills education used by the World Health Organization (WHO, 1997) and developmental psychological models on the etiology of youth problem behavior, as well as empirical findings on risk and protective factors for substance misuse (e.g., Scheier, 2010; Stone, Becker, Huber, & Catalano, 2012). IPSY is a comprehensive program that combines training in intra-personal and inter-personal life skills (e.g., self-awareness, assertiveness) with instruction on substance-specific skills (e.g., resistance to peers

PREVENTION OF TOBACCO USE

offering substances). In addition, knowledge concerning substance use (e.g., accurate prevalence rates) is conveyed in an age-appropriate manner. The intervention primarily uses interactive methods (e.g., role plays, group discussion) that have been shown to be the most effective instruction techniques in the context of prevention. This may be particularly due to the fact, that according to Bandura (e.g., 1963), students practice social and emotional competencies together with their peers, and they model and reinforce each others' effective behavioral strategies. Both social and observational learning help to consolidate new behavioral styles, and they are much more effective in promoting skill acquisition as compared to automatic memorization of contents. The program is implemented in schools by teachers who have been trained in a one-day facilitator workshop before each of the three program parts in grades 5, 6, and 7, and who use a comprehensive manual.

Since IPSY is a primary prevention program, it is delivered to early and pre-adolescents long before the majority starts to experiment with the use of addictive substances. As the average age of substance use initiation in Germany is around 12 years, the basic program was developed for students in grade 5 (usually aged 10 to 11 years) with booster sessions in grades 6 and 7. The intervention in grade 5 consists of 15 basic lessons (10 units of 90-minute and 5 of 45 minutes duration). These are followed by seven booster lessons (4 units of 90-minute and 3 units of 45 minutes' duration) in both grades 6 and 7 in order to practice the learned skills within simulated age-typical risk situations.

In each year of program facilitation in grades 5 to 7, one session of the program focuses explicitly on teaching adolescents refusal skills to resist peer pressure. During the lesson in grade 5, for instance, students start with an interactive evaluation of decisions they have to take each day. Then steps for effective decision making are conveyed by the teacher (e.g., evaluate alternatives, think about the consequences of your decisions, take responsibility, and don't let someone talk you into something). After a short role play (i.e.,

PREVENTION OF TOBACCO USE

three children pressure another child to come for a bicycle ride instead of doing homework), students reflect on their experiences with peer pressure and collect ideas on how to optimally respond in such situations and to assertively say no. Further information is given by the teacher on resistance and refusal strategies (worksheets are given to the students). Finally, students actively practice these strategies in a role play (with changing roles on refusing the offer of a cigarette within the peer context). During the lessons on refusal skills in grades 6 and 7, students rehearse communicative strategies to resist peer pressure (worksheets are given to the students) and, again, practice the strategies in role plays (again with changing roles) in age-typical substance-specific situations (vignettes are given by the teachers, i.e., a friend tries to convince you to participate in the drinking game; peers offer you a cigarette; a friend tries to convince you to hide a joint because he/she is under the teacher's surveillance and will be searched accordingly).

Process Evaluation

For the process evaluation (i.e., implementation fidelity and program acceptance), teachers completed a short questionnaire after teaching each session of the program (how much of the planned session content the facilitators were able to deliver, in percent; open format questions on positive and problematic events in the classroom during the IPSY session; Weichold, 2014). Moreover, a short questionnaire was given to the students at the end of each program part in grades 5, 6, and 7 on the acceptance of the IPSY program ["How did you like IPSY?" 1 = not at all to 5 = very much; "Would you like the IPSY program to be taught again?" (yes / no)]. Descriptive analyses revealed with regard to *implementation fidelity*, that teachers were able to convey on average 80% of the content as outlined in the manual in grade 5, 82% in grade 6, and 89% in grade 7. Positive occurrences during the sessions as mentioned by teachers were, for instance, the integration of outsiders, excellent classroom climate, or outstanding group discussions and role plays, while generally very

PREVENTION OF TOBACCO USE

rarely negative aspects were mentioned (only relating to time issues). Regarding *acceptance of the intervention*, the students reported liking the program a lot, and on average about 80% after participating in the three program parts wished the IPSY program to be taught again in their schools (grade 5: 86%, grade 6: 76%, grade 7: 76%). Responses on fidelity, dosage, and acceptance of the program did not vary significantly across the intervention schools. In sum, process evaluation was very satisfactory with regard to fidelity of implementation and program acceptance (see Weichold, 2014 for more detailed information).

Design

This evaluation study used a quasi-experimental prospective intervention-comparison group design with four measurement occasions and school-wise assignment to the respective groups. Between pre-test (fall of 2003) and post-test (spring of 2004) there was an interval of approximately half a year. Two follow-up measurements were gathered within an interval of approximately one year each (spring of 2005 and spring of 2006). The IPSY program was implemented as part of the regular school curriculum. Parents were informed in the run-up to the project via program presentations and letters. They were then asked to give consent to their child's participation in the evaluation part of the study. Parents of only two students refused to take part in the data collection (thus, participation rate was close to 100%, while it was 100% for participating in the intervention). The students completed an anonymous questionnaire of about 60 minutes length, administered by project staff or trained teachers at each measurement occasion in the classroom. Questionnaires were identified and linked across waves of data collection by means of a self-generated code consisting of the day and month of birth, the last letter of the student's first name, and the first three letters of the mother's first name. Study participants in both the intervention and the comparison group received small incentives for filling out the questionnaires at each wave of data collection (e.g., a pen with the study logo).

PREVENTION OF TOBACCO USE

Attrition analyses. In order to find out whether there were any selectivity effects, we compared those students who participated in all four assessments (56.5%) with those who missed one or more (43.5%) on the various background variables mentioned above as well as the mediator and the outcome at all measurement occasions. Attrition effects were generally very small in terms of effect size (cf. Cohen, 1988) and only four effects were significant. Those students who participated in all four waves of data collection were slightly younger, $t(1657) = 3.07, p < .01, d = .16$, had fewer siblings, $t(1601) = 3.19, p < .01, d = .16$, and smoked more often at post-test, $t(1351) = 1.98, p < .05, d = .11$, and at T3, $t(1220) = 2.27, p < .05, d = .14$. They did not differ on any other background variable nor on smoking at pre-test and T4 and on yielding to peer pressure at any measurement occasion.

Measures

Intervention status. Participation in the IPSY program was treated as a dummy-coded variable where 0 referred to the comparison group and 1 to the intervention group.

Tobacco use. At each measurement occasion students were asked how often they had smoked in the last 30 days. The response categories were “never,” “less frequently than once in a month,” “once in a month,” “once a week,” “several times a week,” and “on a daily basis.” The categories were re-coded to reflect the number of days in a month on which the adolescents presumably smoked, with 0 indicating the “never” category and 30 “on a daily basis.”

Yielding to peer pressure. Peer pressure was measured by a scale of eight items (Santor, Messervey & Kusumakar, 2000). Item wordings were, for instance, “If other students want something from me, I can hardly say no,” or “Sometimes I do stupid or dangerous things just because other want me to do so” (none of the items explicitly refers to smoking). Students were asked to rate how much the statements in the items applied to them on a 5-point Likert scale; higher values meant more yielding to peer pressure, or less resistance to peer

PREVENTION OF TOBACCO USE

pressure. Response options ranged from 1 (*not true at all*) to 5 (*very true*). Internal consistency was satisfactory and ranged between $.67 < \alpha < .83$.

Statistical analyses

We used the framework of latent growth modeling (see Bollen & Curran, 2006) to identify linear trajectories of intra-individual change in the frequency of tobacco use and to predict this change by intervention status. A latent growth model with intervention status as a covariate was used to address Hypothesis 1. It was hypothesized that participation in the IPSY program would predict a slower increase of tobacco use over time (i.e., slope). Concerning the prediction of the intercept of tobacco use, we expected no effect of participation in the IPSY program as such an effect would indicate shortcomings in the assignment to the intervention and comparison groups.

In order to test the hypothesized mediation effect as predicted by Hypothesis 2, we modeled the outcome variable simultaneously with the supposed mediating variable in a parallel process latent growth curve model as suggested by Cheong, MacKinnon, and Khoo (2003). This approach allowed us to investigate how the mediating mechanism affected the progression of tobacco use as a function of participation in the IPSY program. As can be seen in Figure 1, the parallel process model consists of basically three parts. The first part summarizes the manifest longitudinal measurements of the mediator (M_{PRE} , M_{POST} , M_3 and M_4) into two growth components: the intercept at the first measurement occasion and a linear slope. Both the latent intercept and the latent slope component have a mean representing the average trajectory and a variance representing inter-individual variation around the average latent trajectory. The second part describes the manifest longitudinal measurements of the outcome variable (Y_{PRE} , Y_{POST} , Y_3 and Y_4) in terms of a latent intercept mean and a latent slope mean (including variances). The third part of the model is a dichotomous variable indicating whether a participant belonged to the intervention (IPSY) or the comparison group.

PREVENTION OF TOBACCO USE

By setting up structural paths between the three parts of the model it is possible to test the relationships between intervention status, longitudinal change in the mediator, and longitudinal change in the outcome. For the purpose of a mediation analysis, three paths are of particular relevance (see Figure 1). First, the path from intervention status to the slope of the mediator variable (α) represents the effect of the intervention on change in the mediator. If it is significant, it shows that the slopes of the mediator were significantly different for the intervention and the comparison group. In our case we would expect that yielding to peer pressure increases less (or resistance to peer pressure is higher) in the intervention group as compared to the comparison group. Second, the path from the slope of the mediator to the slope of the outcome (β) represents the association between change in the one variable and change in the other variable. A significant path would indicate that adolescents whose yielding to peer pressure increases less strongly would also increase their tobacco use to a lesser degree. Finally, the path from intervention status to the slope of the outcome (τ') represents the residual intervention effect that cannot be explained by the mediator. If path τ' is not significant but paths α and β are, one can assume that the effect of the intervention was totally mediated by the mediator. Mediation itself is tested directly by assessing whether the indirect effect from intervention status via the slope of the mediator to the slope of the outcome ($\alpha\beta$) is significantly different from zero. If this is the case one can assume that changes in the outcome are a function of changes in the mediator which in turn is influenced by the intervention status. For all calculations, we used Mplus 6.1 and employed the robust maximum likelihood estimator MLR (Muthén & Muthén, 2010). Missing data was handled with full information maximum likelihood (see Enders, 2010). The growth models were specified taking into account the uneven spacing between the measurement points. Linear slope factor loadings, for instance, were fixed at 0, 1, 3, and 5 (a one-unit change in time

PREVENTION OF TOBACCO USE

represents the average linear change in raw scores within half a year). Because students were clustered within schools, all analyses were conducted with the Mplus command COMPLEX

Results

Preliminary analysis

The average frequency of tobacco use increased over time from $M_1 = .28$ ($SD_1 = 2.45$) over $M_2 = .68$ ($SD_2 = 4.00$) and $M_3 = 1.32$ ($SD_3 = 5.57$) to $M_4 = 3.07$ ($SD_4 = 8.23$). This indicates that smoking was virtually non-existent at the pre-test measurement and increased to an average of approximately three days a month on which students aged 13 years smoked. The percentage of students who smoked at least once during the past 30 days increased from 5.6% at the first measurement occasion to 24.1% at the last (T2: 7.9%, T3: 12.5%). The intra-class correlation (ICC) for the frequency of tobacco use within schools ranged $.00 < r_{ICC} < .13$.

The average endorsement to the scale measuring yielding to peer pressure was rather low ($M_1 = 1.71$, $SD_1 = .65$; $M_2 = 1.75$, $SD_2 = .64$; $M_3 = 1.73$, $SD_3 = .63$; $M_4 = 1.85$, $SD_4 = .67$) as was the stability between adjacent measurement occasions ($.33 < r < .38$). The ICC for peer pressure within schools ranged $.02 < r_{ICC} < .07$.

Program effect on frequency of tobacco use

We hypothesized that IPSY program participants would show a slower increase in frequency of tobacco use in the intervention as compared to the comparison group (H 1). The linear latent growth model describing the frequency of tobacco use conditional on the intervention status fit the data well, $\chi^2(8) = 18.63$, $p = .02$, $RMSEA = .028$, $SRMR = .047$ and thus we accepted this model. Both the intercept ($M = 0.13$) and the slope of tobacco use ($M = 0.67$) were significantly different from zero ($p < .01$) and the two variance components ($\psi_{intercept} = .96$, $SE = .54$, $p = .08$; $\psi_{slope} = 1.43$, $SE = .30$, $p < .001$) were uncorrelated ($r = .04$; $p = .75$). The standardized effect (STDY in Mplus) of the intervention status on the slope of tobacco use was $\tau = -.24$ ($SE = .13$; $p < .05$) which suggests a significantly slower increase in

PREVENTION OF TOBACCO USE

the frequency of tobacco use in the intervention group as compared to the comparison group during the course of the study. The effect is depicted in Figure 2, which shows a slower increase of tobacco use in the intervention group so that at the last measurement occasion students from the comparison group on average smoked almost twice as frequently as students from the intervention group. The corresponding effect size (Cohen's d) in terms of a difference in observed means between intervention and comparison group at the last measurement point was $d = .20$, indicating a small but substantial intervention effect (Cohen, 1988).

// Please insert Figure 1 about here //

Mediator analyses

In our second hypothesis (H2), we proposed that yielding to peer pressure would mediate the program effect of IPSY on change in the frequency of tobacco use. The parallel process model set up to test this hypothesis fit the data well, $\chi^2(28) = 69.08$, $p < .01$, $RMSEA = .030$, $SRMR = .043$, and was thus accepted. We found that both the intercept ($M = 1.70$) and the slope ($M = .04$) of yielding to peer pressure were significantly different from zero ($p < .01$) as were their variance components ($\psi_{\text{intercept}} = .12$, $SE = .01$, $p < .001$; $\psi_{\text{slope}} = .003$, $SE = .001$, $p < .01$). As can be seen in Figure 1, IPSY participants had a slower increase in yielding to peer pressure ($\alpha = -.42$; $SE = .20$; $p < .05$) as compared to the comparison group. An increase in yielding to peer pressure, in turn, was positively associated with increasing tobacco use ($\beta = .56$; $SE = .13$; $p < .01$). The two effects together resulted in a significant indirect effect of IPSY on tobacco use ($\alpha\beta = -.24$; $SE = .12$; $p < .05$), which suggests, in line with Hypothesis 2, that a reduced increase in yielding to peer pressure (induced by the IPSY program) acts as mediator to explain the positive program effects of IPSY on change in smoking during adolescence. Notably, the significant direct effect of the intervention program on change in tobacco use that was found in the previous univariate growth model was

PREVENTION OF TOBACCO USE

virtually reduced to zero ($\tau' = .01$; $SE = .16$; $p = .94$) in the mediator model which suggests a full mediation of the program effect on change in tobacco use by change in yielding to peer pressure. We furthermore found that a higher level of yielding to peer pressure (or lower resistance to peer pressure) at baseline predicted a higher increase in the frequency of smoking throughout adolescence ($\gamma_4 = .29$; $SE = .06$; $p < .01$). This implies that yielding to peer pressure at age 10 is a risk factor for an unfavorable trajectory of tobacco use during adolescence. All other coefficients can be found in Figure 2. Besides a significant correlation between the intercept of yielding to peer pressure and intercept of smoking ($r = .16$; $p < .01$) no other structural coefficient was significant²

// Please insert Figure 2 about here //

Note that the outcome variable was highly skewed which might have affected results of the statistical analyses. To deal with that issue, we performed three additional analyses. First, we dichotomized the outcome variable and predicted smoking/non-smoking in a logistic mediational model. Second, we dichotomized the outcome, recoded this variable to obtain “life-time prevalence” of smoking across the four measurement occasions, and again computed a logistic mediational model. Finally, we treated the outcome variable as censored and computed a Tobit mediation model. All three approaches led to virtually the same results and standard errors even tended to be smaller, which indicated the robustness of the findings.

Discussion

This study investigated the effects of the life skills program IPSY on change in tobacco use in a sample of early adolescents from Germany. The majority of existing studies did not include a long-term perspective and focused on older age groups whereas in the current study effects were analyzed over a three-year study interval from ages 10 to 13, covering a life phase where smoking is frequently initiated in the context and under the influence of peers (e.g., Pandina et al., 2010). In his study, we investigated a sample from

PREVENTION OF TOBACCO USE

Germany, a cultural context with higher prevalence rates (and, thus higher exposure to smoking role models for youth), and less strict tobacco control strategies as compared to the U.S. (e.g., WHO, 2013), where the majority of prior research on the effectiveness of tobacco prevention programs for adolescents was conducted.

We found, in line with our hypotheses, a significant effect of program participation on the slope of tobacco use over time, indicating that IPSY reduced the age-typical increase in smoking frequency during early adolescence. More specifically, at the last measurement occasion students from the comparison group on average smoked almost twice as frequently compared to their age mates of the intervention group after participating in the IPSY program. Broken down by user vs. non-user status at T4 only 21% of adolescents of the intervention group as compared to 28% of the comparison group smoked during the past 30 days. The effect size in terms of a mean difference between the intervention and comparison group at the last measurement point was rather small ($d = .20$), but according to Tobler et al. (2000) it lies in the upper range of what can be expected of a school-based interactive life skills program. Consequently, this program can be deemed an effective strategy to reduce smoking behavior during early adolescence.

We were particularly interested in whether yielding to (vs. resisting) peer pressure mediated the program effects on change in smoking during early adolescence. This expectation was based on earlier theoretical and empirical work stressing the importance of peer influences as risk factors for early adolescent smoking behavior (Griffin & Botvin, 2010; Hopfer et al., 2013; Kobus, 2003; MacKinnon et al., 2002). First, we tested whether the program influenced change in the potential mediator positively. We found that the life skills program IPSY was effective in reducing yielding to peer pressure during the course of the study. This result resembles findings concerning other life skills programs which aim at the prevention of adolescent substance use and also found positive effects on skills and

PREVENTION OF TOBACCO USE

competencies conducive to effective peer interactions and resistance towards social pressure by peers (e.g., Botvin & Griffin, 2004; Botvin, Griffin, Diaz, & Ifill-Williams, 2001; Bühler et al., 2007). In addition, our study demonstrated that such competencies (i.e., resistance skills) can be positively modified even over several years of early adolescence, instead of the usually shorter time periods as shown in earlier research. This was probably the case because within the program IPSY, as mentioned above, resistance skills were practiced and applied in age-typical challenging situations within same-aged peer groups in a systematic fashion over three years of program implementation. Thereby, suggestions for optimal design of life skills curriculums across several years, as introduced by WHO (1997), were realized in IPSY program development. The lessons dealing with assertiveness and resistance skills in the IPSY program start out with the facilitation of basic skills to say “No” which subsequently are practiced within more and more specific situations with regard to substance use during the booster sessions in grades 6 and 7. Consequently, a curriculum designed to promote resistance skills to deal with peer influences implemented across several years of education seems to be particularly effective to improve competencies at long-term.

However, knowing that a program is effective to promote skills for resisting peer influence does not necessarily mean that these skills indeed are related to a less pronounced increase in consumption of cigarettes in early adolescence observable after taking part in the intervention. Consequently, mediation analyses were performed to investigate whether the change in the protective factor transmits the effects of group assignment on change in substance use (Howe et al., 2002). The current study demonstrated that the lower increase in yielding to peer pressure as compared to the comparison group mediated the program effects on the change in frequency of smoking cigarettes in German students during early adolescence. This result is in line with findings of other life skills programs, and programs based on the social influence approach which showed for somewhat older students that

PREVENTION OF TOBACCO USE

resistance to peer pressure and a reduction in peer influence were mediators of program effects on substance use (e.g., Botvin et al., 1999; Orlando et al., 2005). In addition, Bühler et al. (2007) showed that knowledge of skilled behavior during peer interactions such as assertiveness partly mediated the effect of a life skills program on smoking during early adolescence. Thus, lower yielding to peer pressure to engage in deviant and unhealthy behaviors seems to be an important defense against the influence of risk factors in the peer domain that relate to a high increase in tobacco use during early adolescence (see also Andrews & Hops, 2010; Griffin & Botvin, 2010). This seems to be true in various contexts with a different cultural embedding of tobacco smoking and different implementation status of tobacco control strategies (i.e., Germany vs. U.S.), thus, resistance to peer pressure in early adolescence seems to represent a rather universal protective factor against early tobacco use.

This study has strengths but also several weaknesses. Its strengths include the use of a latent growth modeling approach to analyze change over time, and to explore the mediating effect of a dynamic variable (change in peer pressure) on the outcome (frequency of smoking). More specifically, data were analyzed using complex but suitable statistical methods (i.e., the framework of complex longitudinal growth modeling; Bollen & Curran, 2006). The parallel process growth modeling used in testing mediation effects (Cheong et al., 2003) enabled us not only to provide a gross assessment of whether the program worked or not. More importantly, it allowed us to identify the underlying mechanism of how the program achieved its effects by capturing longitudinal change in the mediating variable and the outcome. Several researchers have argued that longitudinal growth modeling is superior in answering questions about longitudinal change whereas assessing “only” pre- and post-intervention scores might prove inadequate in many research contexts (e.g., Rogosa, 1988; Willet & Sayer, 1994). Major advantages of our approach were the estimation of individual differences in change over time, the simultaneous modeling of both the mediator and outcome

PREVENTION OF TOBACCO USE

process, the high robustness of the method against short-term fluctuations of scores between two single time points, and the use of the maximum amount of information on individual change that was available. Another positive aspect of this study is that the selection of the possible mediator of program effects was based on a strong theoretical and empirical foundation (Cuijpers, 2002; Kobus, 2003; Pandina et al., 2010), focusing on risk mechanisms that were deemed particularly important for the development of tobacco use at the beginning of adolescence. Finally, this study was conducted in a cultural context where adolescents are exposed to many role models and pro-smoking cues in their environment, and where tobacco control strategies, in particular at school-level, were less strictly implemented (which, consequently, creates a more risky context for the development of smoking habits in early adolescence) as compared to the U.S., where the majority of prior research was conducted.

Limitations of this study relate to the quasi-experimental *design* of the study, as it was not possible to randomly assign schools to treatment and comparison conditions. Schools which indicated their interest in an intervention program formed the intervention group. Thereby, self-selection biases could be the result. However, comparisons of the intervention and comparison group showed that both, intervention and comparison group were equivalent at pre-test in many regards, including school characteristics, a school's interest in intervention programs, and various characteristics of teachers and students in the intervention and comparison group. Nevertheless, randomization would be an optimal prerequisite for applying causal interpretations to findings. In addition, given the longitudinal nature of the study, the risk of attrition bias has to be considered. However, for waves 1 to 4 of this study, analyses showed virtually no attrition effects. Furthermore, although this study has already covered several years of adolescent development, follow-up data are needed to investigate long-term effects. Such follow-up assessments are underway and will permit testing for lasting program effects in the future.

PREVENTION OF TOBACCO USE

Other limitations concern *measurement* issues. We covered only one parameter of student behavior. It may well be that other prominent risk factors (e.g., in the area of peer dynamics or social networks) act as mediators of the program effects on adolescent tobacco use. However, such peer-related variables were not adequately measured in the current study. Consequently, an important aim for future studies may include detailed assessments on the structure and qualities of peer interactions within large-scale evaluation studies. Another limitation of the study is that we did not collect detailed data at the school level to describe environments of intervention and comparison schools in more depth (we were only able to investigate differences school with regard to size and inhabitants of the school location as based on official statistics). To control for differences at the school level, in the statistical analyses school was taken into account. However, future studies should include measures on the school environment to allow more detailed descriptions of the sample. In addition, although we were able to compare the teachers of the intervention and comparison group in many regards, we did not gather data on their own consumption behavior which could influence the messages they give to the students with regards to normativity of substance use. Although teachers have to stick to a very detailed and explicit manual when delivering the program, and the aim of the program is to teach skills for responsible usage rather than conveying zero-tolerance messages, such teacher effects and the gathering of appropriate data for testing them should be considered in further studies.

Regarding the *discussion* of our findings, although we found that the direct effect of program participation disappeared by introducing the mediator into the model, we cannot conclude from this study that the other program components included in the IPSY program are ineffective. The facilitation of broad life skills, creating an unusual learning environment with new rules on how to interact with each other, and the open discussion of critical topics, as is usual for life skills programs, might represent an important basis for learning and

PREVENTION OF TOBACCO USE

practicing resistance to peer pressure. Greater school involvement and a better classroom climate as stimulated by the IPSY program, for instance, have been shown to act as mediators of program effects on substance use (Wenzel et al., 2009). Thus, further research should also include more (also qualitative) measures on life skills and school environment.

With regard to the *transfer* of the findings of our study, we focused on the role of peer resistance skills as mediator of program effects on tobacco use in because peer influences is a salient risk factor for smoking in early adolescence (e.g., as reflected in higher social contagion reasons to smoke than to drink during adolescence; BZgA, 2011). Findings on other age periods, based on adolescents following problematic developmental pathways with early onset of smoking, or by using different substances as outcomes may differ - this issue needs further investigation in the future.

To conclude, this study is one of the few examining mediation effects of a life skills program on change in tobacco use based on a longitudinal study of early adolescent students from Germany, applying modern and complex techniques for data analysis. The results highlight the importance of promoting skills relevant to resisting peer influence to impede early tobacco use in young adolescents and its various negative health and psychosocial outcomes in later life (Mathers, Toumbourou, Catalano, Williams, & Patton, 2006). As this study showed, resistance to peer pressure seems to reflect a major protective factor for smoking in early adolescence that can be changed by a life skills program, as evidenced by the positive effects of the IPSY program on adolescent smoking. In addition, although the effect size suggests a “small” intervention effect of the program, this is nevertheless meaningful given the fact that IPSY is a universal prevention program for entire population groups, and given the fact that students of the comparison condition at the end of the study on average smoked almost twice as frequently as students from the intervention group. Further

follow-up assessments of the sample up to adult life will clarify how sustainable these effects are in the future.

References

- Andrews, J. A., & Hops, H. (2010). The influence of peers on substance use. In L. M. Scheier (Ed.), *Handbook of drug use etiology* (pp. 403-420). Washington, DC: American Psychological Association.
- Bandura, A. & Walters, R. H. (1963). Social learning and personality development. New York: Holt Rinehart and Winston.
- Bollen, K. A., & Curran, P. J. (2006). *Latent curve models: A structural equation approach*. Hoboken, NJ: Wiley.
- Botvin, G. J. & Griffin, K. W. (2007). School-based programmes to prevent alcohol, tobacco and other drug use. *International Review of Psychiatry*, 19, 607-615.
- Botvin, G. J., & Griffin, K. W. (2004). Life Skills Training: Empirical findings and future directions. *The Journal of Primary Prevention*, 25, 211-232.
- Botvin, G. J., Griffin, K. W., Diaz, T., & Ifill-Williams, M. (2001). Drug abuse prevention among minority adolescents: Posttest and one-year follow-up of a school-based preventive intervention. *Prevention Science*, 2, 1-13.
- Brener, N. D., Kann, L., McManus, T., Kinchen, S. A., Sundberg, E. C., & Ross, J. G. (2002). Reliability of the 1999 youth risk behavior survey questionnaire. *Journal of Adolescent Health*, 31, 336-342.
- Bühler, A., Schröder, E., & Silbereisen, R. K., (2007). The role of life skills promotion in substance abuse prevention: A mediation analysis. *Health Education Research*, 23, 621-632.

PREVENTION OF TOBACCO USE

- Bundeszentrale für Gesundheitliche Aufklärung [BZgA] (2011). *Der Tabak- und Alkoholkonsum Jugendlicher und junger Erwachsener in Deutschland 2010. Ergebnisse einer aktuellen Repräsentativbefragung und Trends*. [The consumption of tobacco and alcohol in adolescents and young adults in Germany 2010]. Köln: BZgA.
- Cheong, J., MacKinnon, D. P., & Khoo, S. T. (2003). Investigation of mediational processes using parallel process latent growth curve modelling. *Structural Equation Modeling, 10*, 238-262.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cuijpers, P. (2002). Effective ingredients of school-based drug prevention programs: A systematic review. *Addictive Behaviours, 27*, 1009-1023.
- DeGarmo, D. S., Eddy, J. M., Reid, J. B., & Fetrow, R. A. (2009). Evaluating mediators of the impact of the Linking the Interests of Families and Teachers (LIFT) multimodal preventive intervention on substance use initiation and growth across adolescence. *Prevention Science, 10*, 208-220.
- Dobbins, M., DeCorby, K., Manske, S., & Goldblatt, E. (2008). Effective practices for school-based tobacco use prevention. *Preventive Medicine, 46*, 289-297.
- Enders, C. K. (2010). *Applied missing data analysis*. New York: Guilford Press.
- Fend, H. (2005). Rauchen als Risiko-Indikator für jugendliche Lebensstile. Stabilität und Folgen für soziale Übergänge [Smoking as risk indicator for adolescent life styles. Stability and consequences for social transitions]. *ZSE – Zeitschrift für Soziologie der Erziehung und Sozialisation, 25*(1), 82-94.
- Griffin, K. W. & Botvin, G. J. (2010). Evidence-based interventions for preventing substance use disorders in adolescents. *Child and Adolescent Psychiatric Clinics of North America, 19*, 505-526.

PREVENTION OF TOBACCO USE

- Grünbaum, C. (2009). *Untersuchung der Effekte des Lebenskompetenzenprogramms IPSY auf unterrichtende Lehrer [Evaluation of the effects of the life skills program IPSY on implementing teachers]*. University of Jena: Unpublished diploma thesis.
- Haas, A. L., & Smith, S. A. (2012). The relationship of smoking status to alcohol use, problems, and health behaviors in college freshman. *Journal of Research on Adolescence*, 22(4), 758-767.
- Hanewinkel, R., & Sargent, J. D. (2007). Exposure to smoking in popular contemporary movies and youth smoking in Germany. *American Journal of Preventive Medicine*, 32(6), 466-472.
- Hansen, W. B., Derzon, J., Dusenbury, L., Bishop, D., Campbell, K., & Alford, A. (2010). Operating characteristics of prevention programs: Connections to drug use etiology. In L. M. Scheier (Ed.), *Handbook of drug use etiology* (pp. 597-616). Washington, DC: American Psychological Association.
- Helweg-Larsen, M., & Nielsen, G. A. (2009). Smoking cross-culturally: Risk perceptions among young adults in Denmark and the United States. *Psychology and Health*, 24(1), 81-93.
- Hibell, B., Guttormsson, U., Ahlström, S., Balakireva, O., Bjarnason, T., Kokkevi, A., & Kraus, L. (Eds.) (2012). *The 2011 ESPAD Report. Substance use among students in 36 European countries*. Stockholm: The Swedish Council for Information on Alcohol and Other Drugs.
- Hoffman, B. R., Sussman, S., Unger, J. B., & Valente, T. W. (2006). Peer influences on adolescent cigarette smoking: a theoretical review of the literature. *Substance Use & Misuse*, 41, 103-155.

PREVENTION OF TOBACCO USE

- Hopfer, S., Hecht, M. L., Lanza, S. T., Tan, X., & Xu, S. (2013). Preadolescent drug use resistance skill profiles, substance use, and substance use prevention. *Journal of Primary Prevention, 34*, 395-404.
- Howe, G. W., Reiss, D., & Yuh, J. (2002). Can prevention trials test theories of etiology? *Development and Psychopathology, 14*, 673-694.
- Huang, T. T., Unger, J. B., & Rohrbach, L. A. (2000). Exposure to, and perceived usefulness of, school-based tobacco prevention programs: Associations with susceptibility to smoking among adolescents. *Journal of Adolescent Health, 27*, 248-254.
- Jaccard, J., Blanton, H., & Dodge, T. (2005). Peer influences on risk behavior: An analysis of the effects of a close friend. *Developmental Psychology, 41*, 133-147.
- Jit, M., Aveyard, P., Barton, P., & Meads, C. A. (2010). Predicting the life-time benefit of school-based smoking prevention programmes. *Addiction, 105*, 1109-1116.
- Johnson, K. W., Shamblen, S. R., Ogilvie, K. A., Collins, D., & Saylor, B. (2009). Preventing youths' use of inhalants and other harmful legal products in frontier Alaskan communities: A randomized trial. *Prevention Science, 10*, 298-312.
- Kobus, K. (2003). Peers and adolescent smoking. *Addiction, 89*, 37-55.
- Kumar, R., O'Malley, P. M., Johnston, L. D., & Laetz, V. B. (2013). Alcohol, tobacco, and other drug use prevention programs in U.S. schools: A descriptive summary. *Prevention Science, 14*, 581-592.
- La Torre, G., Chiaradia, G., & Ricciardi, G. (2005). School-based smoking prevention in children and adolescents: review of the scientific literature. *Journal of Public Health, 13*(6), 285-290.
- Li, F., Barrera, M., Jr., Hops, H., Fischer, J., & Harmer, P. (2002). The longitudinal influence of peers on the development of alcohol use in late adolescence: a growth mixture analysis. *Journal of Behavioral Medicine, 25*, 293-315.

PREVENTION OF TOBACCO USE

- Liu, L. C., Flay, B. R., & Aban Aya Investigators (2009). Evaluating mediation in longitudinal multivariate data: Mediation effects for the Aban Aya Youth Project Drug Prevention program. *Prevention Science, 10*, 197-207.
- MacKinnon, D. P., Taborga, M. P., & Morgan-Lopez, A. A. (2002). Mediation designs for tobacco prevention research. *Drug and Alcohol Dependence, 68*, 69-83.
- Mathers, M., Toumbourou, J. W., Catalano, R. F., Williams, J., & Patton, G. C. (2006). Consequences of youth tobacco use: A review of prospective behavioural studies. *Addiction, 101*, 948-958.
- McIntosh, J., MacDonald, F., & McKeganey, N. (2006). Why do children experiment with illegal drugs? The declining role of peer pressure with increasing age. *Addiction Research and Theory, 14*, 275-287.
- McNeal, R. B., Jr., Hansen, W. B., Harrington, N. G., & Giles, S. M. (2004). How All Stars works: An examination of program effects on mediating variables. *Health Education & Behavior, 31*, 165-178.
- Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide* (6th ed.). Los Angeles, CA: Muthén & Muthén.
- Orlando, M., Ellickson, P. L., McCaffrey, D. F., & Longshore, D. L. (2005). Mediation analysis of a school-based drug prevention program: Effects of Project ALERT. *Prevention Science, 6*, 35-46.
- Pandina, R. J., Johnson, V. L., & White, H. R. (2010). Peer influences on substance use during adolescence and emerging adulthood. In Scheier, L. (Ed.), *Handbook of drug use etiology: Theory, methods, and empirical findings*, pp. 383-401. Washington, DC: APA.

PREVENTION OF TOBACCO USE

- Pearson, M., Sweeting, H., West, P., Young, R., Gordon, J., & Turner, K. (2006). Adolescent substance use in different social and peer contexts: A social network analysis. *Drugs: Education, Prevention and Policy*, 13, 519-536.
- Piontek, D., Buehler, A., Rudolph, U., Metz, K., Kroeger, C., Gradl, S., Floeter, S., & Donath, C. (2008). Social context in adolescent smoking: Does school policy matter? *Health Education Research*, 23, 1029-1038.
- Pötschke-Langer, M. (2005). Rauchfreie Schulen – Bedeutung und Umsetzung [Smoking-free schools – Meaning and Implementation]. *Informationsdienst zur Suchtprävention*, 17, 13-24.
- Ringwalt, C., Pankratz, M., Gottfredson, N., Jackson-Newsom, J., Dusenbury, L., Giles, S., Currey, D., & Hansen, B. (2009). The effects of students' curriculum engagement, attitudes toward their teachers, and perception of their teachers' skills on school-based prevention curriculum outcomes. *Journal of Drug Education*, 39, 223-237.
- Rogosa, D. (1988). Myths about longitudinal research. In K. W. Schaie, R. T. Campbell, W. Meredith, & S. C. Rawlings (Eds.), *Methodological issues in aging research* (pp. 171-205). New York: Springer.
- Sakuma, K.-L., Sun, P., Unger, J. B., & Johnson, C. A. (2010). Evaluating depressive symptom interactions on adolescent smoking prevention program mediators: A mediated moderation analysis. *Nicotine & Tobacco Research*, 12, 1099-1107.
- Santelli, J. S., Sivaramakrishnan, K., Edelstein, Z. R., & Fried, L. P. (2013). Adolescent risk-taking, cancer risk, and life course approaches to prevention. *Journal of Adolescent Health*, 52(2), 41-44.
- Santor, D. A., Messervey, D., & Kusumakar, V. (2000). Measuring peer pressure, popularity, and conformity in adolescent boys and girls: Predicting school performance, sexual attitudes, and substance use. *Journal of Youth and Adolescence*, 29, 163-182.

PREVENTION OF TOBACCO USE

Schafer, J. L. (1997). *Analysis of incomplete multivariate data*. London: Chapman & Hall.

Scheier, L. M. (Ed.) (2010). *Handbook of drug use etiology*. Washington, DC: American Psychological Association.

Schulenberg, J., Maggs, J., Steinman, K., & Zucker, R. (2001). Developmental matters: Taking the long view on substance abuse etiology and intervention during adolescence. In P. Monti, S. Colby, & T. O'Leary (Eds.), *Adolescents, Alcohol, and Substance Abuse: Reaching Teens through Brief Interventions* (pp. 19-57). New York: Guilford Press.

Simons-Morton, B. G. & Farhat, T. (2010). Recent findings on peer group influences on adolescent smoking. *Journal of Primary Prevention*, 31, 191-208.

Skara, S. & Sussman, S. (2003). A review of 25 long-term adolescent tobacco and other drug use prevention program evaluations. *Preventive Medicine*, 37, 451-474.

Spaeth, M., Weichold, K., Silbereisen, R. K., & Wiesner, M. (2010). Examining the differential effectiveness of a life skills program (IPSY) on alcohol use trajectories in early adolescence. *Journal of Consulting and Clinical Psychology*, 78, 334-348.

Stephens, P. C., Sloboda, Z., Stephens, R. C., Teasdale, B., Grey, S. F., Hawthorne, R. D., & Williams, J. (2009). Universal school-based substance abuse prevention programs: Modeling targeted mediators and outcomes for adolescent cigarette, alcohol and marijuana use. *Drug and Alcohol Dependence*, 102, 19-29.

Stigler, M. H., Perry, C. L., Smolenski, D., Arora, M., & Reddy, K. S. (2011). A mediation analysis of a tobacco prevention program for adolescents in India: How did project MYTRI work? *Health Education & Behavior*, 38, 231-240.

Stone, A. L., Becker, L. G., Huber, A. M., & Catalano, R. F. (2012). Review of risk and protective factors of substance use and problem use in emerging adulthood. *Addictive Behaviors*, 37, 747-775.

PREVENTION OF TOBACCO USE

- Sussman, S., Pokhrel, P., Ashmore, R. D., & Brown, B. B. (2007). Adolescent peer group identification and characteristics: A review of the literature. *Addictive Behaviors*, 32, 1602-1627.
- Thomas, R. E., McLellan, J., & Perera, R. (2013). School-based programmes for preventing smoking (Review). *Cochrane Database of Systematic Reviews*, Issue 5. doi: 10.1002/14651858.CD001293.pub3
- Tobler, N. S., Roona, M. R., Ochsborn, P. Marshall, D. G., Streke, A. V., & Stackpole, K. M. (2000). School-based Adolescent drug prevention programs: 1998 meta-analysis. *Journal of Primary Prevention*, 20, 275-336.
- Valente, T. W., Gallaher, P., & Mouttapa, M. (2004). Using social networks to understand and prevent substance use: a transdisciplinary perspective. *Substance Use & Misuse*, 39(10-12), 1685-1712.
- van Lier, P. A., Huizink, A., & Vuijk, P. (2011). The role of friends' disruptive behavior in the development of children's tobacco experimentation: Results from a preventive intervention study. *Journal of Abnormal Child Psychology*, 39, 45-57.
- Weichold, K. (2007). Prevention against substance misuse: Life skills and positive youth development. In R. K. Silbereisen & R. M. Lerner (Eds.), *Approaches to positive youth development* (pp. 293-310). London: SAGE.
- Weichold, K. (2014). *Suchtprävention in der Schule [Addiction prevention within school]*. Göttingen: Hogrefe.
- Weichold, K., Brambosch, A., & Silbereisen, R. K. (2012). Do girls profit more? Gender-specific effectiveness of a Life Skills Program against substance misuse in early adolescence. *Journal of Early Adolescence*, 32, 200-225.

PREVENTION OF TOBACCO USE

- Wenzel, V., Weichold, K., & Silbereisen, R. K. (2009). The life skill program IPSY: Positive influences on school bonding and prevention of substance misuse. *Journal of Adolescence*, 32, 1391-1401.
- Willet, J. B., & Sayer, A. G. (1994). Using covariance structure analysis to detect correlates and predictors of individual change over time. *Psychological Bulletin*, 116, 363-381.
- World Health Organization [WHO] (1997). *Life skills education in schools*. Geneva, Switzerland: World Health Organization.
- World Health Organization [WHO] (2002). *Prevention of psychoactive substance use. A selected review of what works in the area of prevention*. Geneva, Switzerland: World Health Organization.
- World Health Organization [WHO] (2011). *Global status report on alcohol and health 2011*. Geneva, Switzerland: World Health Organization.
- World Health Organization [WHO] (2013). *WHO Report on the Global Tobacco Epidemic 2013*. Geneva, Switzerland: World Health Organization.

Footnotes

¹ We found that in one school of the intervention group, teachers and students were particularly unmotivated to participate in data collections and in the program itself, pointing to a high risk for gathering unreliable data and extremely low program acceptance and fidelity. Results of the data analyses supported this. First, process evaluation revealed problems in program facilitation in this school such that students were inattentive and not actively participating during the lessons. Second, in this school, students reported smoking on $M = 3.91$ days a month at pre-test (as compared to $M = .28$ in all other schools), then dropped to $M = 1.95$ days at posttest (as compared to $M = .68$), increased to $M = 16.13$ at T3 (as compared to $M = 1.32$), and again dropped to $M = 8.04$ days at T4 (as compared to $M = 3.07$). This erratic pattern was primarily due to a few students in this school who at some measurement occasions (but not others) reported smoking on a daily basis. Consequently, we excluded this school ($N = 28$ students) for the current study because of unreliable data for tobacco use.

² Possible gender and age effects on the validity of the study findings were explored. By controlling for the effects of gender in the parallel process growth model we found that gender only predicted the intercept of the mediator, but not the intercept of the outcome, and the slopes of mediator and outcome. Since the results of the parallel process growth model that included gender did not differ from the model without gender we excluded gender from the final parallel process growth model. In addition, we tried to explore gender differences by applying a multiple group model. We were, however, not able to estimate a multiple group model for boys and girls (the number of parameters exceeded the number of clusters, which typically results in model non-identification). Finally, controlling the parallel process growth model for age did not change any of the model parameters, nor was the significance of any parameters affected.

PREVENTION OF TOBACCO USE

Figure 1.

Average tobacco use in the intervention and comparison groups.

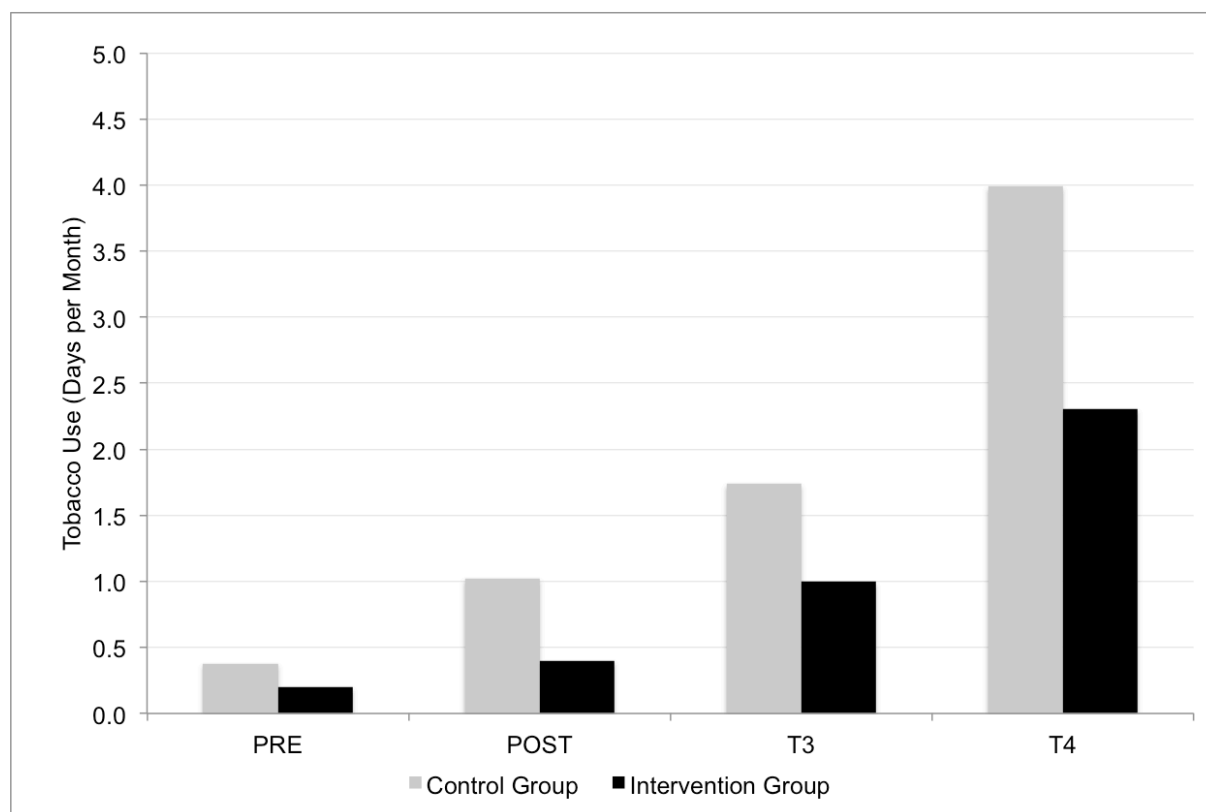
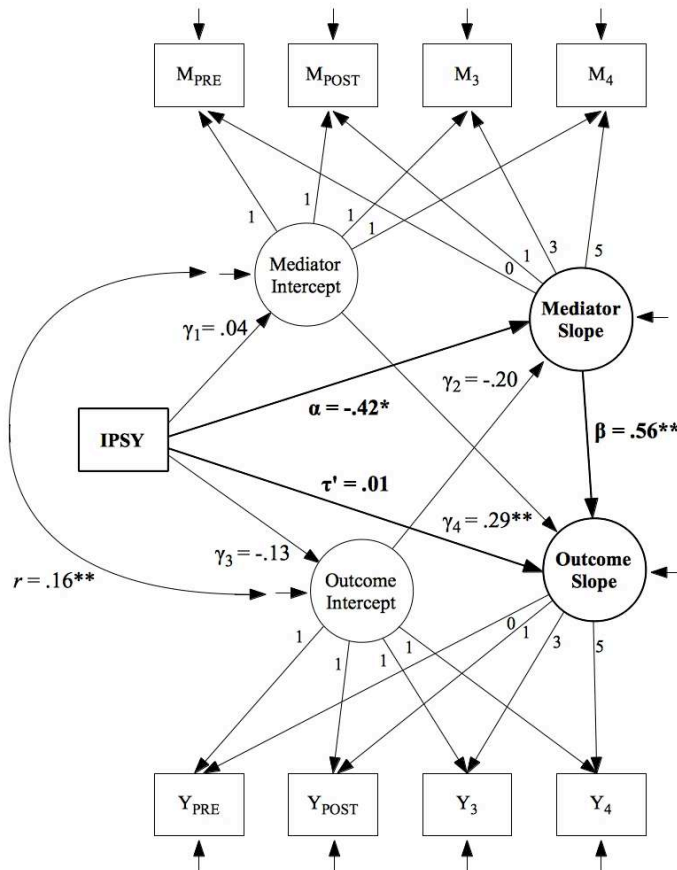


Figure 2.

Parallel process latent growth model for the mediating mechanism of the IPSY program.



Note. M_{PRE} through M_4 represent the manifest measures of the mediator “yielding to peer pressure”, Y_{PRE} through Y_4 represent the manifest measures of the outcome “tobacco use”, IPSY is a dichotomous variable representing participation in the prevention program, α represents the effect of the prevention program on change in the mediator, β represents the effect of change in the mediator on change in the outcome, and τ' represents the residual direct effect of the prevention program on change in the outcome. All regression effects are standardized. Components of the figure printed in bold can be conceived as a representation of the traditional “mediation triangle”, whereas paths labeled with γ represent effects not interpreted in a mediation analysis. *: $p < .05$, **: $p < .01$